

ASTHMATIC THERAPY EXPERT SYSTEM (ATES)

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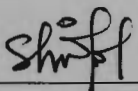
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ABSTRAK (BAHASA MELAYU)

Kebelakangan ini, kes kematian disebabkan oleh penyakit asma telah bertambah dengan mendadak. Oleh itu, tindakan yang berkesan perlu diambil untuk mengatasi masalah ini. Oleh kerana penyakit asma tidak boleh diubati, tetapi pesakit asma mempunyai peluang untuk merawat penyakit ini. Walau bagaimanapun, untuk mencapai kualiti hidup yang baik walaupun mempunyai penyakit asma, pesakit asma perlulah mengawal dan mengurus asma mereka dengan baik dan tegas. Maka, adalah penting untuk menghasilkan sebuah sistem yang dapat membantu pesakit asma dalam mengenal pasti tahap asma mereka berdasarkan tahap bahaya asma tersebut. Objectif projek ini adalah untuk menghasilkan satu prototaip yang boleh memberi cadangan dari segi rawatan yang boleh dilakukan di rumah sama ada dari segi rawatan yang biasa diberi oleh doktor atau terapi menurut perspektif Islam dengan mengumpul pengetahuan dan maklumat daripada pakar-pakar (doktor-doktor perubatan) dan juga dokumen (buku, laporan, jurnal dll). Projek ini mengaplikasikan 'rapid prototyping' sebagai metodologi yang menjadi panduan sepanjang projek ini dijalankan supaya semua keperluan dapat dipenuhi. Kesimpulannya, prototaip yang dicadangkan berjaya dibina dan berdasarkan ujian pengguna yang dijalankan, pengguna prototaip ini berpuas hati dengan prototaip ini dan sanggup untuk menggunakan sistem ini di masa akan datang dalam membantu mereka menguruskan penyakit asma.

ABSTRACT (ENGLISH)

Due to striking increases of death caused by asthma illness, effective actions should be taken in order to overcome the problem. As there are no cure for asthma but there are chances for asthmatic patients to treat the illness. However, in order to get a better asthma-related quality of life, patients need to control or to manage their asthma with care and strictly. Therefore, it is important to provide a system that can help the patient to manage their asthma which can recognize level of asthma according to its severity. The project's objective is to develop a prototype that suggesting homecare treatment either towards conventional asthma medication or Islamic approach by acquitting knowledge from human expert (medical doctors) and from documents (medical books, journals, reports etc). The project used rapid prototyping as methodology to guide throughout the process from initial specification of the project until the evaluation stage in order to make sure all requirements have been met. As a result, the prototype is successfully being built and based on the user testing that have been conducted, users are fully satisfied with the prototype and they are willing to use the system to help them managing their asthma illness.

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
ES	Expert System
ATES	Asthmatic Therapy Expert System
IgE	Immunoglobulin E

CHAPTER ONE: INTRODUCTION

Artificial Intelligence (AI) can be defined as the branch of computer science that is concerned with the automation of intelligent behavior (Luger, 2005). The goal of AI as in science perspective is to make machines do things that would require intelligence if done by humans. Based on Oxford Advanced Learner's Dictionary (2005), the meaning of artificial is something that is being made or produced in order to copy something that is natural. Intelligence is being defined by Essential English Dictionary (1990) as the ability to think, to understand and learn things instead of doing things by instinct or automatically. In the world of computer science, commonly AI is being described as a computer or program which exhibit behavior that indicates intelligence. How do we know whether the computer or program is intelligent? According to Legg and Hutter (2007), a computer or program can be categorized as intelligent when it has computational models of human behavior (act like human does), computational models of human "thought" (think like human does), can behave intelligently (can act exactly like a human does) and rationally (can differentiate between the right thing to do or otherwise) as shown in **Figure 1.1**:

The contents of
the thesis is for
internal user
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CHAPTER FIVE: CONCLUSION AND FUTURE WORK

This report has presented a prototype system called Asthmatic Therapy Expert System (ATES). ATES is an ES that has been developed based on expert's knowledge for monitoring asthmatic illness. This prototype can suggest to asthmatic patients appropriate treatments to be taken at home before they go to see a human doctor. The system also can recommend meditation therapies based on Islamic approach.

For the future works, prototype system should be embedded into mobile devices as it will give more impact on giving guidance to the user. Besides, it will be better for the system to be available all the time, anywhere in order to give more services to the users.

The prototype also needs to be integrated with other systems that already available on the market. It is suggested that the prototype is integrated with a system that can manage the patient records on peak flow rates that will give the patients or users more related information. Moreover, if the prototype is integrated with a system that can send direct reports of their current situation to the hospital or to their doctors, this will give more benefits to the asthmatic patients and also to medical doctors who handle their cases.

The prototype system should be enhanced such that users know the time for prayer (for Muslim user) as prayer also is one of the meditation.

REFERENCES

Abdul Razak Mutallif (2008, May 11). *Lebih 400 juta pesakit asma menjelang 2025*.

Utusan Malaysia. Retrieved from

http://www.utusan.com.my/utusan/arkib.asp?y=2007&dt=0729&pub=utusan_malaysia&sec=kesihatan&pg=kn_04.htm&arc=hive

Angeli C. and Chatzinikolaou A. (2006). *On-line model-based fault detection for proportional valves*. Proceedings of the 25th IASTED international conference on Modeling, identification, and control. pp. 291 – 296.

Anonymous (2008a). *Manage your asthma*. Retrieved June 10, 2008 from

http://www.asthma-acm.com.my/con_02.cfm

Anonymous (2008b). *Understanding asthma*. Retrieved June 10, 2008 from

http://www.asthma-acm.com.my/con_01.cfm

Anonymous (2007, July 22). *Pesakit ambil mudah tahap asma*. Utusan Malaysia.

Retrieved from

http://www.utusan.com.my/utusan/arkib.asp?y=2007&dt=0722&pub=utusan_malaysia&sec=kesihatan&pg=kn_03.htm&arc=hive

Anonymous (2008, July 7). *Membongkar kelebihan saintifik solat*. Retrieved July 9,

2008 from

http://www.utusan.com.my/utusan/arkib.asp?y=2008&dt=0707&pub=utusan_malaysia&sec=rencana&pg=re_07.htm&arc=hive

Applied Biosystem. (2008). *Product bulletin: human identification*. California, United State.

Asthma Society of Canada. (2006). *State of the asthma nation september bulletin*. Canada.

Asthma Society of Canada. (2007). *State of the asthma nation april bulletin*. Canada.

Asthma UK. (2006a). *Fact file: food reactions and asthma*. United Kingdom.

Asthma UK. (2006b). *Fact file: exercise and asthma*. United Kingdom.

Asthma UK. (2006c). *Fact file: severe asthma symptoms & ways to control them*. United Kingdom.

Asthma UK. (2008). *Asthma magazine: take control*. United Kingdom.

Asthma UK. (2007). *Emergency asthma care*. United Kingdom.

AstraZeneca. (2003). *Patient education: asthma*. Canada.

Athanasios Tom Koutsavlis, Tom Kosatsky, Joseph Cox, Eric Goyer (2001). *Reporting childhood asthma: why? Why not? What else?* Journal of Public Health Policy, Vol. 22, No. 3, (2001), pp. 311-319. Palgrave Macmillan Journals.

Awad, E. M (1996). *Building expert systems: principles, procedures and application*. West Publishing Company. Minnesota, United State.

Baruchin A. (2007, September 13). *Tracking an urban plague*. The New York Times.

Retrieved from <http://health.nytimes.com/ref/health/healthguide/esn-asthmachildren-qa.html?scp=1&sq=Tracking%20an%20Urban%20Plague&st=cse>

Black, W.J. (1986). *Intelligent knowledge based systems: an introduction*. Van Nostrand Reinhold: UK.

Buchanan B.G. and Duda R.O.(1982). *Principles of rule-based expert system*. M. Yovits(ed.) Advances in Computers, Vol.22, New York: Academic Press

Bull E. and Price D (2005). *A simple guide to asthma*. CSF Medical Communication Ltd. Oxfordshire. United Kingdom.

Cawsey, A. (1998). *The essence of artificial intelligence*. Prentice-Hall: England.

Depolo J. (2005). *Breath easy*. Futures magazine. Vol. 23, No. 2. Retrieved from <http://www.worldandijournal.com.eserv.uum.edu.my/subscribers/searchdetail.asp?num=25372>

Dobbs V.S., Davis H.W., Lizza C. (1988) *An application of heuristic search techniques to the problem of flight path generation in a military hostile environment*. Proceedings of the 1st international conference on Industrial and engineering applications of artificial intelligence and expert systems, Volume 1. pp. 273-280.

Duke E.L. and Regenie V.A. (1985). *Expert systems development and application*. United State.

Fajar A. (1999). *Himpunan doa dan zikir*. Inabah Publishing. Kuala Lumpur.

- Franklin, J.E., Carmody, C.L., Keller, K., Levitt, T.S., Buteau, B.L. (1988). *Expert system technology for the military: selected samples*. Proceeding of the IEEE, Volume: 76, Issue: 10. pp. 1327-1366.
- Filippetti F., Franceschini G., Tassoni C., Vas P., (2000). *Recent developments of induction motor drives fault diagnosis using ai techniques*. IEEE Transactions On Industrial Electronics, Vol. 47, No. 5.
- Giangrande P. (1991). *A-z of family health*. BCA. London.
- Global Initiative Asthma. (2007). *Global strategy for asthma management and prevention*. Retrieved June 10, 2008 from <http://www.ginasthma.org>.
- Global Initiative Asthma. (2006). *Pocket guide for asthma management and prevention*. Retrieved June 10, 2008 from <http://www.ginasthma.org>.
- Gordon V.S. and Bieman J.M. (1995). *Rapid prototyping: lesson learned*. IEEE Software, 12(1):85{95.
- Haron D. and Amran K. (1990). *Rawatan pesakit menurut al-quran dan as-sunnah*. Percetakan Watan Sdn Bhd. Kuala Lumpur. Malaysia.
- Kais R. (2002). *Meditation: another great way to worship god*. Submitters Perspective, Volume 18, No 11. pp. 3-4. Tucson.
- Leach R.J. (2000). *Introduction to software engineering*. CRC Press LLC. Florida. United State.

- Legg S. and Hutter M. (2007). *Universal intelligence: a definition of machine intelligence*. Mind and Machines. Volume 17 , Issue 4. Kluwer Academic Publishers, Massachusetts.
- Lehner P.E. (1986). *On the role of artificial intelligence in command and control*. IEEE Transactions on Systems, Man, and Cybernetics, Vol. Smc-16, No. 6.
- Leitner P J. (2000). *The doctor will 'virtually' see you now*. Retrieved June 10, 2008 from
<http://www.worldandijournal.com.eserv.uum.edu.my/subscribers/searchdetail.asp?num=21005>
- Luger, G.F (2005). *Artificial intelligence: structures and strategies for complex problem solving*. Fifth Edition. Addison-Wesley Publishing Corporation: New York.
- Marchewka J.T. (2003). *Information technology project management: providing measurable organizational value*. John Wiley and Sons Inc. United State.
- Martin, S. and Oxman, S. (1988). *Building expert systems: a tutorial*. Prentice Hall: New Jersey
- McCarthy J. (2007). *What is artificial intelligence?* Retrieved from <http://www-formal.stanford.edu/jmc/>
- Meditation Expert. (2008). *Islamic meditation*. Retrieved July 9, 2008 from
<http://www.meditationexpert.co.uk/IslamicMeditation.html>

National Asthma Council Australia. (2008a). *World asthma day is may 6, 2008: got asthma? you need a plan!*. Australia.

National Asthma Council Australia. (2008b). *Asthma deaths spike*. Australia.

National Pharmaceutical Council. (2004). *Disease management for asthma*. United State.

Noran O.S. (n.a). *The evolution of expert systems*. Retrieved July 9, 2008 from <http://cit.gu.edu.au/~noran>.

O'Bryne P. (2007). *Global strategy for asthma management and prevention*. Retrieved from <http://www.ginasthma.com/Guidelineitem.asp??l1=2&l2=1&intId=60>

O'Callaghan T.A., Popple J., McCreath E., (2003). *Shyster-mycin: a hybrid legal expert system*. ICAIL '03: Proceedings of the 9th international conference on Artificial intelligence and law.

Oxford Advanced Learner's Dictionary. (2005) Seventh Edition. Oxford University Press. Great Clarendon Street, Oxford, New York.

Perry G and Sanjaya Hettihewa (1998). *Teach yourself:visual basic 6*. Sams Publishing. United State.

Pomykalski J.J., Truszkowski W.F., Brown D.E., (1999). *Expert systems*. Wiley Encyclopedia for Electrical and Electronics Engineering, J. Webster.

Rahana MD (2004, September 9). *Asma - gejala boleh dibasmi sepenuhnya*. Utusan Malaysia. Retrieved from

http://www.utusan.com.my/utusan/arkib.asp?y=2004&dt=1209&pub=utusan_malaysia&sec=keluarga&pg=ke_02.htm&arc=hive

Reddy, R. (1996). *The challenge of artificial intelligence*. Computer, pp: 86-98.

Rozeboom R.W. (1988). *Texas instruments (india) private limited: a global informatics model*. Pergamon Press, Inc. New York, United State.

Russel, S.J and Norvig, P (1999). *Artificial intelligence: a modern approach*. Prentice Hall: New Jersey.

San Diego Childhood Asthma Initiative. (n.a) *Asthma education for childcare providers*. United State.

Turban, E., and Aronson, J. E. (2001) *Decision support systems and intelligent systems* (6th Eds.). Prentice Hall: New Jersey.

US National Institute of Health (2007). *Expert panel report 3: guidelines for the diagnosis and management of asthma*. National Asthma Education and Prevention Program. United State.